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American Engineers Perfect First Wingless Airplane

New York Men Outstrip French Inventors in Developing Machine Designed to Solve Problem of Vertical Ascension

Ground Tests of Helicopter No. 1 Give Every Promise of Success Aloft—Preparations Nearly Complete for Trial Flight

By ROBERT G. SKERRETT.

WE have beaten them to it! Two American engineers are a year or more ahead of those ingenious Frenchmen who claim to be in a fair way to produce a wingless plane. Best of all, for the satisfaction of local pride, success has been won by New Yorkers.

Very recently a special cable from Paris announced that the French Government had paid $40,000 for the patent rights of a flying machine, in the experimental stage, which is utterly unlike any aircraft yet constructed. The men responsible for the design are Prof. Louis Lacoin, of the Central School of Arts and Manufactures, and Louis Damblanc, an engineer; and these inventors declare that they have solved the problem of vertical ascension, slow flight and immobility in the air. It seems that the machine, while commenced two years ago, has not yet been made ready for trial; and to perfect their full-sized model and to put it to a test the Government has lent a helping hand.

This official action is evidence of the technical promise of the new aircraft, and proof, besides, that the French authorities are fully alive to the military advantages of such a type. According to the despatch from Paris, suspension in the air and the propulsion of the flying machine will depend upon two four-bladed propellers the surfaces of which are made of the material commonly employed in covering the wings of airplanes, but of more than the usual strength. Speed of ascension and the velocity of horizontal flight are to be regulated by altering the angles of the propeller blades. Steering is to be done by two small planes at the tail of the craft.

Called Helicopter.

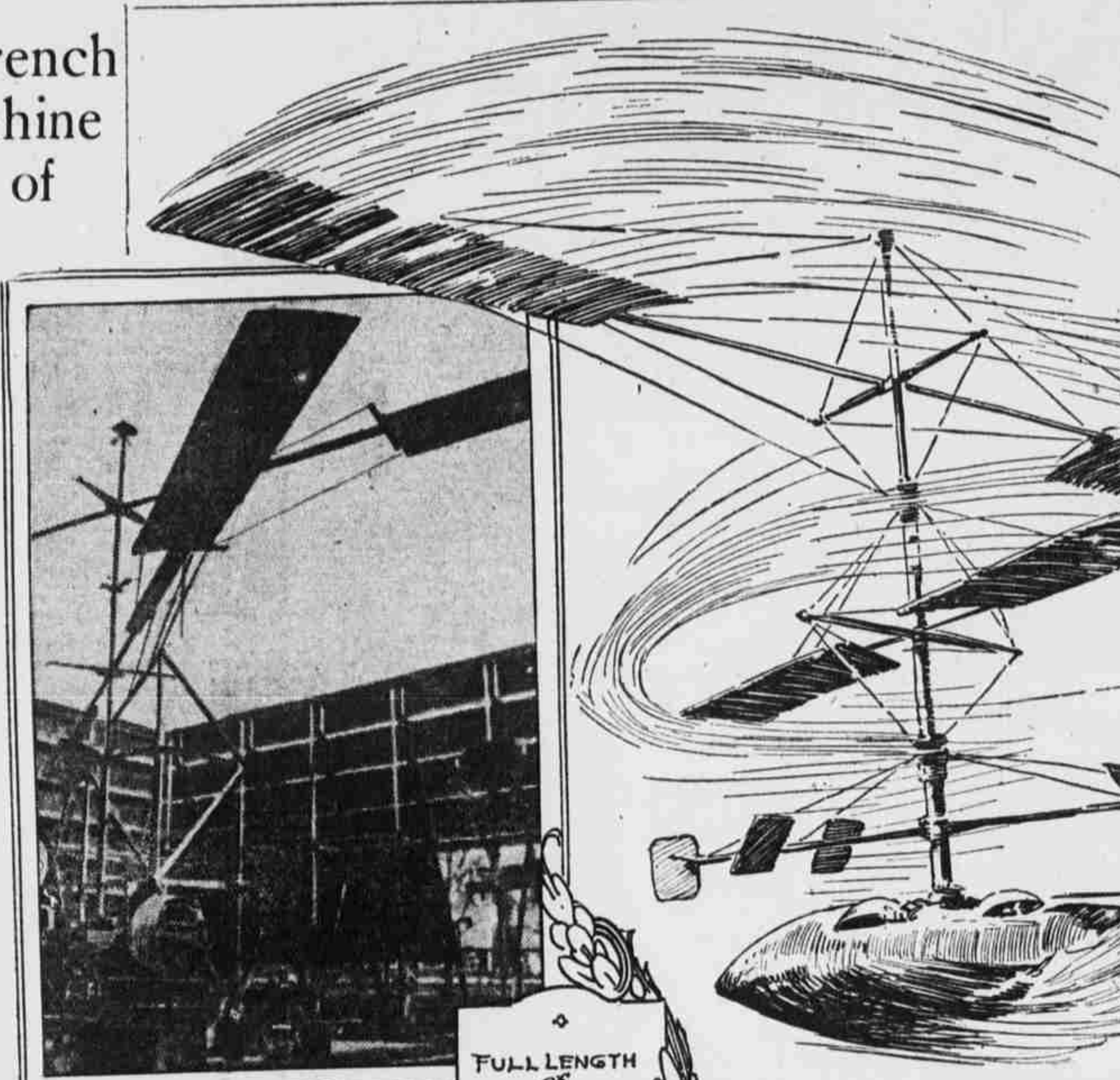
In the absence of further details it is evident that the inventive Frenchmen are busy upon what is technically termed in aeronautical parlance a helicopter. That is to say, there are no wings to help promote a sustaining effort in the air. The craft, on the other hand, will rely entirely upon the action of its two screws to lift it bodily from the earth and then to drive it forward when at the desired height above ground. Similarly, by altering the speed of the propellers sufficiently the lifting force will be just enough to neutralize gravitation and make it possible for the machine to poise at a chosen altitude, or by decreasing the measure of this upward thrust of the screws the craft will descend slowly to its landing place. One has to have only the slightest knowledge of the way an airplane leaves the ground, flies or returns to terra firma to grasp the fact that Messieurs Lacoin and Damblanc are intent upon giving the world something decidedly revolutionary in heavier than air machines.

The helicopter has lured many engineering geniuses to a disappointing outcome. Somehow failure dominated in the end notwithstanding the seeming correctness of the plans and calculations. The potential virtues of the type have been generally recognized, but the one great hampering requirement was the development of the large lift essential to getting the machine off the ground.

Even the latest books on aeronautics compiled or written by recognized authorities in the art do not mince matters when pointing out the impracticability of the helicopter. This state of mind on the part of the vast majority of the experts in aviation is of more than common interest because we shall see that the supposedly wise men of the science of mechanical flight have been utterly discredited by actual performance here. This denouement should, indeed, reward and encourage to further effort those who have in any way contributed to the achievement of the wingless craft built a year or so ago in secret at Ampere, N. J.

New York's Men and Funds.

The New Yorkers who have given us the jump on the French, in fact the rest of the world, are Dr. Peter Cooper Hewitt and Prof. Francis Bacon Crocker, aided by funds furnished by a small group of Gothamites who wished thus to do their bit toward beating the Germans. Indeed, the promoting cause in undertaking to develop a really workable, practical helicopter was to provide us with an order of aircraft which would strengthen us aloft against the dreaded coming of hostile Teutons to our very shores. It is significant that the United States Government in no way contributed to the realization of this particular endeavor—private capital and the patriotic labors of the technicists referred to alone made accomplishment possible.

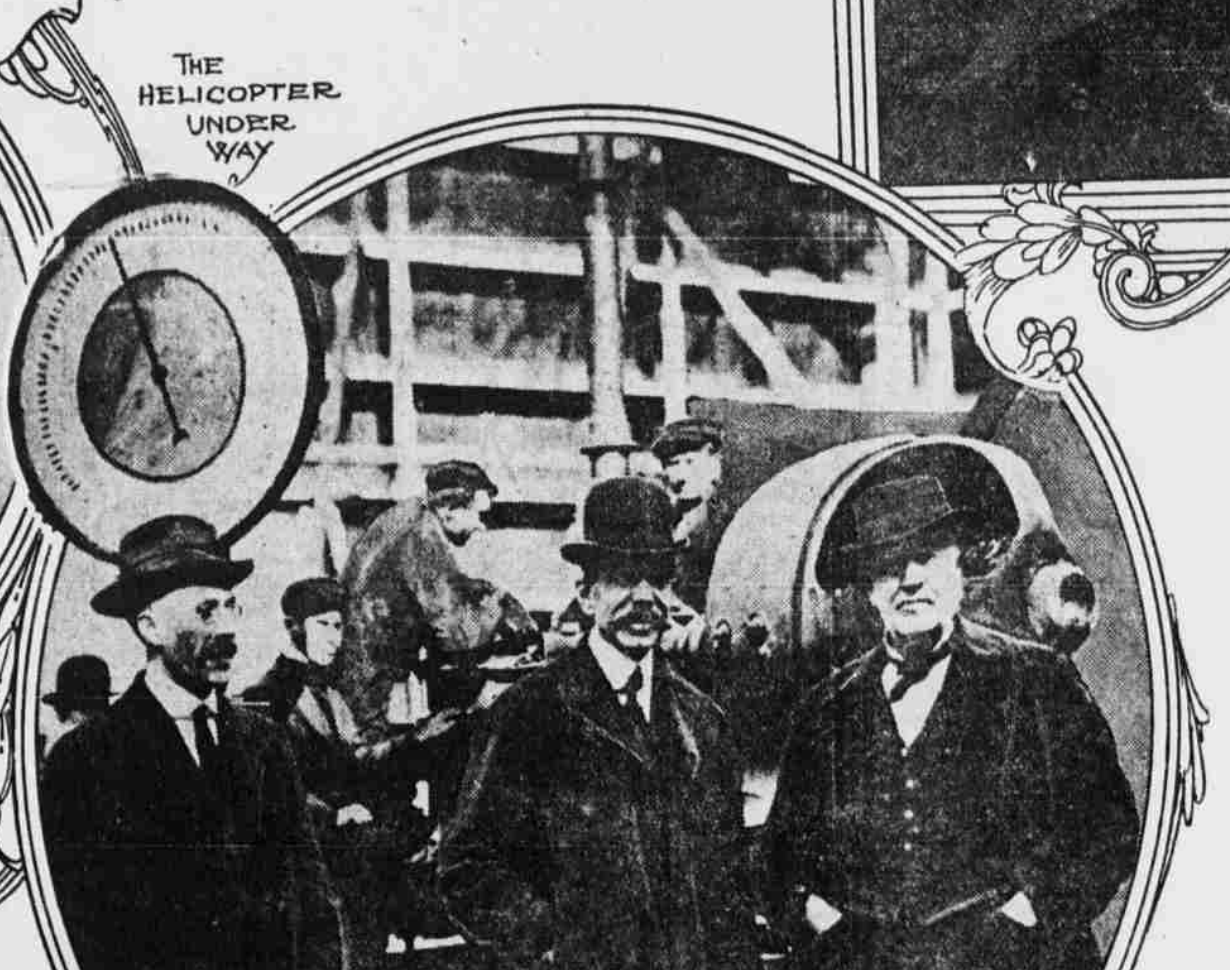


FULL LENGTH OF HELICOPTER No. 1 UNDERGOING GROUND TESTS

PROF. FRANCIS BACON CROCKER

DR. HEWITT EXPLAINS ONE OF THE INTRICACIES TO MR. EDISON

THE HELICOPTER UNDER WAY



DR. PETER COOPER HEWITT (CENTER) THOMAS A. EDISON (RIGHT) DIAL ON LEFT REGISTERED THE "LIFT" IN POUNDS OF THE PROPELLERS.

About 1906 Dr. Hewitt became absorbed in the problem of the helicopter. As most of us know, mechanical flight was very much in its infancy at that time. While Dr. Hewitt did not succeed in producing an operable model of the sort he then was seeking, still his labors were fruitful of much valuable data—information that was of the greatest use when he returned again to the problem after we entered the world war. Further scientific research and mechanical developments in the interval put facts and facilities at his disposal which were not available in 1906. He was certain that it was practicable to build a satisfactory helicopter, notwithstanding the prevailing belief to the contrary. As Prof. Crocker expresses it: "This disfavor had no scientific basis; it was merely a remnant of the old fashioned prejudice against flying machines' in general."

Accordingly, after long and careful study, Dr. Hewitt and Prof. Crocker became convinced that there were the best of reasons for a third type of aircraft—something that could compete with the balloon and the airplane and possess besides important advantages over each of these accepted designs. Therefore they approached a few of their friends and then, with means at their disposal, these two engineers began the building of a machine—a full size, working helicopter, capable of demonstrating the correctness of the principles involved.

Helicopter No. 1 was assembled in nearby New Jersey and put through a protracted series of progressive trials—the procedure being carefully guarded from the public. The outcome was a splendid substantiation of the claims made by Dr. Hewitt and Prof. Crocker. The machine met their fondest hopes and did everything but soar aloft. This was purposely prevented for the best of reasons. To put it popularly, the constructors wanted to make sure that they could walk before essaying to run, and they did not care to send a pilot skyward until every engineering detail was worked out to a satisfying nicety.

As assembled Helicopter No. 1 consisted of what might be called the vital parts of the design. That is to say there were two propellers, one above the other, each of large diameter, rotating horizontally in opposite directions—one being a right hand and the other a left hand screw, but of course both exerting their drive or thrust in a downward direction so as to furnish a lifting impulse.

These propellers were mounted on two vertical shafts consisting of concentric steel tubes, suitably held apart by ball bearings. The upper screw was rotated by the inner shaft and the lower screw by the outer one. These shafts were driven by a skilfully devised bevel gearing which in its turn was actuated by two electric motors placed just where airplane engines would be installed for actual flying.

To be explicit, the supporting framework or engine foundation was designed to carry two airplane motors of a standard type; and Helicopter No. 1, in its engineering essentials, was a practical, man-carrying machine. It lacked only what might be termed superficial features, such as a fusilage, navigational facilities, and the presence of fuel tanks, &c., none of which would have contributed to the solving of the overshadowing problem—that of proving that the propellers, with the power available, would act upon the air strongly enough to raise and transport the estimated weight of a fully appointed dirigible helicopter.

Propellers Chief Problem.

As has been pointed out both by Prof. Crocker and Dr. Hewitt, a successful helicopter must exert a lift that is more than equal to the entire weight of the craft when full laden with the crew aboard. Previous attempts to build a flying machine of this character have failed primarily because the propellers were too small in diameter to act upon a sufficiently large mass of air.

They could not induce the atmospheric reactions needful to raise and to support the total weight involved. The question was how to work upon an ample volume of air and do this in a way that would yield the most efficient results. Plainly, large propellers were necessary, but how should these be modelled? It was just this that had brought other investigators sooner or later squarely up against a stone wall.

Airplane propellers are exceptional when they attain a diameter of ten feet, and most of them probably do not measure more than six feet or so across. Therefore, to make up for this moderate span, they revolve from 1,200 to 2,000 times a minute—this velocity being counted upon to get a sufficient hold upon the elastic medium so that the flying machine can be pulled or pushed forward agreeably to the location of the screws.

Unfortunately the spinning propellers defeat their own effectiveness by this rapidity of rotation because they set in motion the atmosphere for some distance in front of them. In proportion to this disturbance the screws "slip" through the air instead of delivering to it propulsive beats; and if it were not for the airplane's outspread wings the screws alone would not suffice to transform the power of the engines into a sustaining and motive force.

It is probably no exaggeration to say that quite 50 per cent. of the power delivered by an airplane's motors to the propellers is wasted in making what might be called "holes" in the air. Technically this is termed "cavitation." However, men like Gustave Eiffel in France, the aeronautical experts in England, certain airplane builders here and the people in charge of the navy's wind tunnel at Washington have been instrumental in so developing the flying machine's wings that they are remarkably effective as soaring or sustaining members.

Indeed, they are relatively much more efficient for the service expected of them than are any of the propellers built for airplane work up to date. That is to say, the airplane's big wings are called upon to make up for the deficiency of its small driving screws.

With these facts before them Dr. Hewitt and Prof. Crocker had first to decide in a general way upon a radical departure in aviation propellers. More than that, it was needful that they should shut their ears to the ever present sceptic; and, finally, they knew that they would not reach their goal if they accepted the dictum of other helicopter experimenters who announced positively that no propeller could be built and last that had a span in excess of thirty feet. Large as this diameter seems in comparison with the biggest of airplane screws, still the New York scientists knew that they could not realize their hopes unless their propellers were of considerably greater spread from tip to tip.

The propellers placed upon Helicopter No. 1 have a diameter of more than half a hundred feet—to be exact, fifty-one feet! Each has two blades, but in form these blades are radically unlike those which characterize the usual aviation screw. They have the least material where the airplane's propeller bulks largest, and they are patterned directly after the wings of the best of heavier-than-air flying machines.

Each blade is a miniature wing about fifteen feet long and two and a half feet wide supported on the outer section of a tubular steel spoke or arm having a radius of twenty-five and a half feet. By placing the blades thus well away from the hub or shaft and out where the rotary movement makes for the greatest velocity through the air, each square inch of the propelling surfaces does its helpful bit in exercising a lifting impulse.

To obtain lightness in combination with strength, the blades are cunningly fashioned of thin aluminum. They consist of aeroform partitions, placed laterally, which constitute the framework, and over these aluminum ribs is fastened thin plating of the same material where ordinarily cotton or linen fabric is employed in the run of flying machines.

While saving weight, the use of aluminum makes the helicopter's wings noninflammable. Indeed, as both Prof. Crocker and Dr. Hewitt emphasize, the entire helicopter can be constructed of metal, and to that extent lessening the chances of damage and hazard in the presence of flame.

Because wings are dispensed with in the usual understanding of the term, Helicopter No. 1 has a total surface less than ten per cent. of that of an airplane carrying the same load. That is to say, aloft, a machine of that model would meet with correspondingly reduced resistance when travelling through the air. Owing in part to this fact, it is declared that the helicopter, for a given engine power, will raise a bigger weight or, if desired, will go a good deal faster than an airplane of identical capacity. That is to say, the total available lift per horse-power, which, of course, can be utilized in rising or in speeding ahead, is one hundred per cent. greater than that of the best airplanes extant to-day!

It has been said that the small propeller, by reason of its high velocity, sets up hampering disturbances in the air. Therefore, even though the experts evolved a satisfactory propeller of extraordinary diameter, it was no less necessary that the screws should revolve at a low rate of speed, comparatively speaking. The intention was not to exceed something like a hundred turns a minute!

At the same time it was realized that the aircraft had to be planned to utilize regular airplane engines. Now these motors, to make them efficient, are built to run at the rate of twelve hundred or more revolutions a minute. Manifestly, they could not be coupled up directly with the fifty-one foot screws. The engineers' task, therefore, was to provide an intermediate mechanism that would "step down" the motors' rapid pace.

This was done in an exceedingly ingenious and simple way by means of a reduction gear devised by Dr. Hewitt. It consists of two horizontal gear wheels—one attached to the shaft of the upper screw and the other to the shaft of the lower propeller, which take their motion alike from both primary motors. In this way, while the two screws act independently, they both obtain their power from the whole propulsive equipment.

In other words, if one engine were to fail the two propellers would still turn under the impulse of the remaining active motor. This is important, because a helicopter of the type in question could, if crippled in this way, return to the earth so slowly that it would not be injured by contact with the ground. If the screws were less effective than they are this manoeuvre would be quite out of the question—the machine would drop at a disastrous rate.

Can Use More Engines.

Dr. Hewitt did more than merely develop a reducing gear that would meet the requirements of Helicopter No. 1. Owing to the way in which he has placed his speed-reducing gear wheels—cutting down fourteen hundred turns of the motors to one hundred revolutions of the propeller shafts—it is entirely practicable to connect with them one or more additional engines by simply inserting driving pinions between these wheels at suitable points. The arrangement is popularly comparable to placing a greater number of chairs around a table.

Therefore, it is feasible and easy to add to the power of the total propulsive plant, using all of the motors to obtain greater speed or lift, or holding one of them inactive until needed. This load of an idle engine would not hamper a helicopter, thanks to the abundant margin of lift made possible by its exceptionally effective propellers. A reserve motor thus provides a large factor of safety, and a helicopter so equipped can stay aloft when one engine goes dead.

Helicopter No. 1, during its months of ground testing, was driven by two electric motors each of 100 horsepower when running at full speed. However, they were not turned up to their full capacity simply because that was une

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